Linear Models – Number of Employees and Annual Payroll

Description:

Students will use 2007 Economic Census data in order to interpret the slope and intercept of a linear model in the context of the data.

Standard:

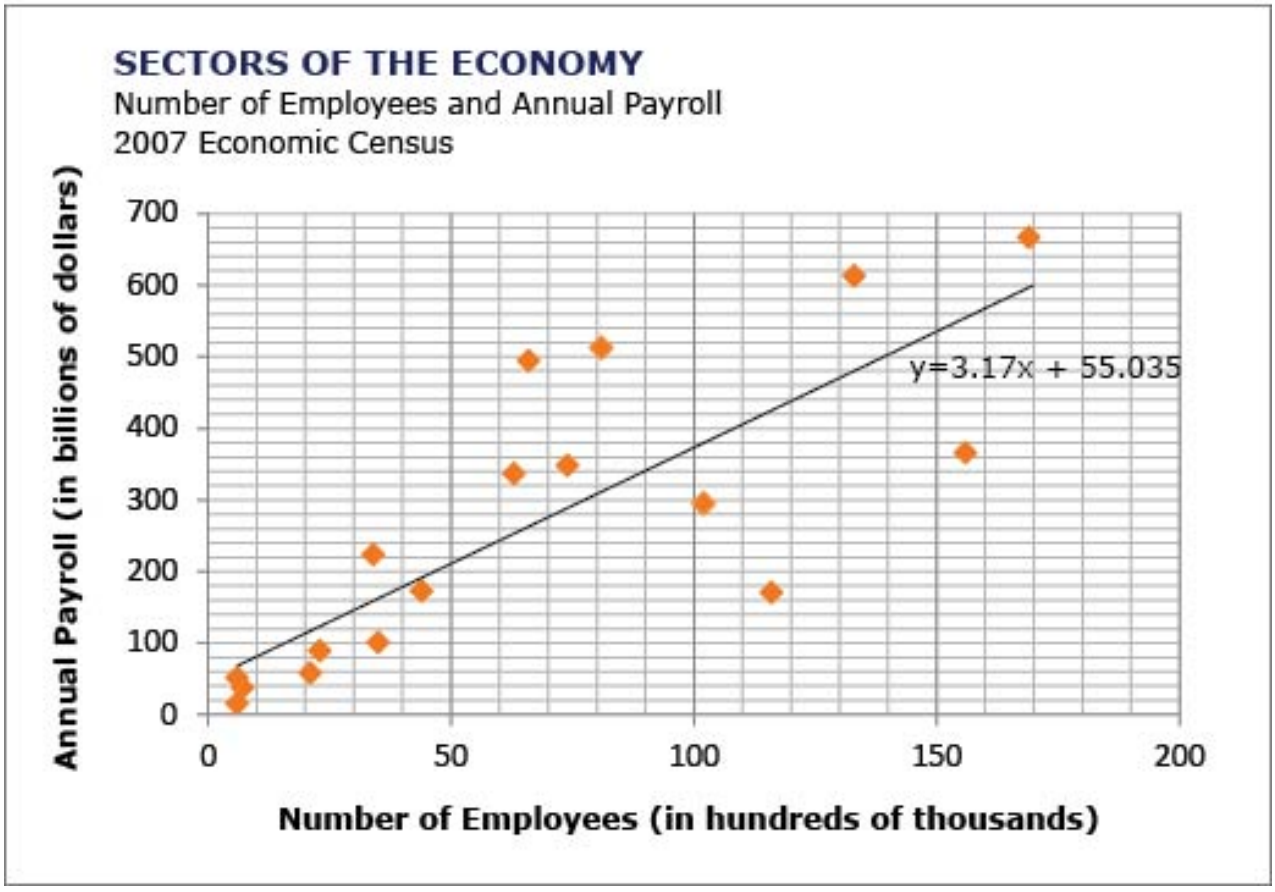
CCSS.Math.Content.HSS-ID.C.7:Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Activity Instructions for Students

Every five years, the U.S. Census Bureau conducts the economic census, which is the U.S. Government's official measure of American business and the economy. Forms go out to more than four million businesses, including large, medium, and small companies representing all U.S. locations and industries. The results of the economic census provide the government with key source data for the Gross Domestic Product (GDP) and other indicators of economic performance.

In this activity, you will use data from the 2007 Economic Census to examine the relationship between the number of employees and annual payroll for given sectors of the economy.

Using the provided scatter plot, line of best fit, and linear equation for these data, answer the questions provided below. As you answer the questions, keep in mind the units used for each of the variables.



1. What are the values for the slope and y- intercept of the linear model?

2. Explain, in specific language, what the slope says about these variables.

3. According to the linear model, economic sectors that employ (32), (103), (62) and (159) hundred thousand people would have expected annual payrolls of ____, ____, ____, and ____, respectively.

4. According to the linear model, economic sectors with annual payrolls of $400, $290, $515, and $354 billion would have an expected ____, ____, ____, and ____, hundred thousand employees, respectively.

5. What is the significance of the y-intercept for this model? What does it mean in real-world terms? Does this make sense to you? Why or why not?

6. Write a brief paragraph which summarizes the information about the graph from the preceding question and addresses each of the following points:

a. The variables presented in the graph and their units of measurement.

b. The real-world relationship suggested by the data.

c. The equation that most closely illustrates the relationship between the variables and its behavior.

Activity Assessment

1. **What are the values for the slope and intercept of the line?**

Slope = 3.17; y- intercept = 55.03

2. **Explain, in specific language, what the slope says about these variables.**

A slope of 3.17 says that for every increase of 100,000 employees in an economic sector, you can expect a $3.17 billion increase in annual payroll for that economic sector.

3. **According to the linear model, economic sectors that employ (32), (103), (62) and (159) hundred thousand people would have expected annual payrolls of ____, ____, ____, and ____, respectively.**

a. $156.64 billion

b. $379.06 billion

c. $251.89 billion

d. $559.86 billion

4. **According to the linear model, economic sectors with annual payrolls of $400, $290, $515, and $354 billion would have an expected ____, ____, ____, and ____, employees, respectively.**

a. Approximately 108.65 hundred thousand or 10,865,000 employees.

b. Approximately 74 hundred thousand or 7,400,000 employees.

c. Approximately 144.87 hundred thousand or 14,487,000 employees.

d. Approximately 94.16 hundred thousand or 9,416,000 employees.

5. **What is the significance of the y-intercept in this instance? What does it mean in real-world terms? Does this make sense to you? What are some real-world explanations for why this would be the case?**

A y-intercept of 55.03 means that even when the x-axis value (number of employees) is equal to 0, we would expect that annual payroll to be equal to $55.03 billion dollars. A variety of explanations could be given (most are related to overhead).

6. **Write a brief paragraph which summarizes the information about the graph from the preceding question and addresses each of the following points:**

a. The variables presented in the graph and their units of measurement.

b. The real-world relationship suggested by the data.

c. The equation that most closely illustrates the relationship between the variables and its behavior.

The two variables presented in the graph are number of employees (measured in units of one hundred thousand) and annual payroll (measured in billions of dollars) for a give sector of the economy. According to the data presented in the graph, the two variables show a positive linear association or correlation. In real-world terms, the graph suggests that the greater an economic sector's "number of employees", the greater its "annual payroll." This relationship is illustrated by the equation y = 3.175x + 55.035.

Teacher's Notes

Learning Objectives

Students will:

- Identify the slope and the intercept of a linear equation.
- Associate the sign of the slope with the behavior of the graph (increasing, decreasing) and apply this understanding to the context of the data.
- Interpret the slope and intercept in the context of the data.

Instructions for Teachers

Before this Activity

If needed, review the following key terms and concepts:

- **Sector of the economy** – a group of related industries that follow similar processes and inputs to produce or provide their products or services.
- **Number of employees** – refers to the number of paid employees.
- **Annual payroll** – refers to the total compensation paid to all employees in a sector of the economy in a particular year.
- **Economic census** – conducted every five years by the U.S. Census Bureau, the economic census is the U.S. Government's official measure of American business and the economy. Forms go out to more than four million businesses, including large, medium, and small companies representing all U.S. locations and industries. The results of the economic census provide the government with key source data for the Gross Domestic Product (GDP) and other indicators of economic performance.

Review the concepts related to the linear equation y=mx +b.

During this Activity

Monitor students as they work.

After this Activity

Review the provided solutions with students, allowing them to discuss and compare their own findings.

Review the major concepts of slope and y-intercept, incorporating knowledge gained in the activity as you review.